



IN THE PATENT OFFICE

PATENT APPLICATION

ENTITLED

***"Process for making a versatile clamping device
designed for holding objects [without damage]
while preventing damage thereto, such a
device and its use. "***

(Substitute Specification)

Marked-up copy

IN THE NAME OF

PHILIPPE BERNA

**PROCESS FOR MAKING A VERSATILE CLAMPING DEVICE
DESIGNED FOR HOLDING OBJECTS [WITHOUT DAMAGE] WHILE
PREVENTING DAMAGE THERETO, SUCH A DEVICE AND ITS USE**

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1. FIELD OF THE INVENTION

The present invention relates to a method of making a multipurpose clamping device designed for holding objects [without damaging them] while preventing damage thereto, such a device and its use.

2. PRIOR ART

Among the clamping tools including two jaws, of which one can slide along a straight guide piece, some of them are totally lacking [forceable] forcible pressing means, such as screws, eccentrics, springs, hydraulic means or the like. Thus Ralph K. Coffman has filed in 1945 a patent application to get the US patent No. 2,510,077 which discloses such a tool. Coffman's tool is characterized in that said guide piece comprises several (three on the drawings) parallel and distinct cylindrical rods distributed along the jaws depth, and said jaws are equipped at one of their ends with cork pads facing each other. On the other hand, small bars at each of their ends laterally link the rods to each other [the rods are laterally linked to each other by small bars at each of their ends], the central rod being tied to these small bars. Therefore said jaws are kept imprisoned between these said small end bars. It seems that Coffman was utterly convinced that could the jaws lock by friction on the guide piece, should this guide include several rods and these rods be automatically bent for clamping. Consequently could the jaws be parallel to each other for clamping, should these ones be leaning towards each other at rest, on the cork pads side, by an acute angle.

No more he seemed to be familiar with the [moulding] clamp for décor molding, called "presse-marteau" or "hammer-press", such it has been disclosed page 107, figure 257, in Lombard & Masviel's book, entitled "Cours de Technologie", Band 1 (for wood) and published by Dunod & Pinat in 1907 in Paris. This "hammer-press" which belongs to the kind of clamping tools mentioned at the beginning of this prior art review also locks by friction, but its guide piece comprises only one rod and its jaws are essentially parallel to each other at rest. This "hammer-press" is also found, always offered made of wood (generally of hornbeam wood), in many commercial hardware catalogs. For example, it can be found in [catalogues, such as] the 1910 [one] catalog of "Charbonnel et Fils" based in Thiviers, Dordogne, France [, on] (see figure 378 of 40th plate). It can be also found in [, such as] the 1924 [one] catalog of "Etablissements F. Guitel and Etienne réunis" based in Saint-Martin street in Paris [, on] (see figure 2592 of page 232). It can be as well found in [,and such as] the 1927 [one] catalog of the "Forge Royale" based in Faubourg Saint-Martin street in Paris[,](see figure 306 of [32th] 32nd plate). [Besides the fact that the guide piece comprises only one cylindrical rod, one of the jaws is systematically fixed at one end of said rod and every one of said jaws is lacking any pad,] In these catalogs, the hammer-press is presented with a guide piece comprising only one

else. [, but is] But said jaws are equipped at [the] their farthest end from the rod in front of the other jaw with a place, where a pad could be precisely bonded [sticked] on. [Moreover,] And in 1948, the same "hammer-press" [,with a jaw fixed at one end of the rod and a parallel jaw running on said rod,] is shown [presented on] (see pages 27 and 28, in sight of figure 42) [,] with cork pads at this place, by Trillat, cabinetmaking teacher, in his book entitled "Le Guide Pratique du Mètier" ("The Practical Guide for Skill"), published by Fillet & Combe based in Bourgouin (Isère, France). Henri Trillat has become familiar with the "hammer-press" equipped with cork pads, before becoming teacher of technical education in 1932, as he was an employee in cabinetmaking workshops (as a foreman for furniture manufacturing, at the end). Therefore, he has taught this clamp to his students from 1932. Numerous "hammer-presses" with cork pads can be found in old cabinetmaking workshops in France. A distinctive feature of the "hammer-press", such as it is represented in Trillat's book, is that the straight rod supporting the jaws is circular, whereas in the aforementioned commercial catalogues, the rod is systematically shown with a rectangular section. And this "hammer-press" is hand clamped, as Trillat states it page 83, this time in sight of figure 31 of a revision of his first work, entitled "Technologie Générale et de Spécialité en Menuiserie-Ebénisterie" ("General and Special Technology for Joinery and Cabinetwork) and published by Dunod, Paris, in 1959. This "hammer-press" can be quite compared to the clamps that have been disclosed later on in the patent applications filed by Ditto in May 1981 (to get the US patent No. 4,555,100) and filed by Pappas in November 1984 (PCT/US85/00420 application). The only exception is [except] that the guide piece in Ditto and in Pappas appears to be parted in two parallel straight rods. Pappas considers however, at the two thirds of the page 3 of his application, that the guide piece of the jaws might be made up of only one rod. Both are claiming a clamping tool comprising two jaws and a straight guide piece. One of said jaws is fixed to one end of said guide piece. The other jaw can run along said guide piece parallel to said first jaw and remaining parallel thereto at rest. Each of said two jaws is provided at a distance from said guide piece, as it is for Trillat's "hammer-press", with an elastic cork-type pad facing the other jaw.

3. and 4. SUMMARY AND ADVANTAGES OF THE INVENTION

The present invention is distinct from the prior art evoked before in what it consists in replacing by a substantially elastic buffer any cork pad such as the one which can be found on a jaw of Trillat's "hammer-press".

Therefore, the new clamp can conform to difficult shapes unlike what cannot do prior art clamps like the one of Coffman, or like the "hammer-press".

Thus, a clamping device equipped according to the present invention comprises [the combination of]:

- a cylindrical support part, such as a rod or a tube, with a section circular or not, and*
- two arms each arm including a transverse hole and at least one of these arms carrying an elastic buffer secured thereto, said buffer having a contact face for contacting any object to be clamped and having under its contact face a thickness large enough so that said buffer acts as a compression spring when said buffer contacts said object, and being resilient enough such that said contact face can flex and pivot to substantially conform to the surface of said object. Said support part is disposed within said transverse holes of said arms such that at least one of said*

arms is movable along said support part. And said buffer is disposed at a distance from said support part with its contact face approximately at a right angle to said support part.

[- two arms of which at least one is movable along said support part,

- one substantially elastic buffer secured to one of said arms at a distance from said support part and having under its contact face, which is approximately at a right angle to said support part, a so large thickness that said buffer could act as a compression spring.]

One at least of said two arms being movable means that one arm (the other one) might be fixed. But in combination to the replacement of cork pads by substantially elastic buffers, the two arms can be selected both movable along said support and fit for being easily slipped outwards thereof and inwards again. That gives the "hammer-press" new and considerable possibilities and turns said press into a versatile tool. Indeed not only the new "hammer-press" according to the present invention can be used as a clamp conforming to difficult shapes, but also, when the arms are reversed on the support part, as a spreader to press against a nook [the recess] sides. And [and] when said arms are moreover fit to be turned around it into at least two directions and other such arms are added on same support part, [as] one gets an overlapping clamp, which is a new kind of clamp with four arms providing a spectacularly sturdy and stable clamping [, and] . And with other pairs of arms added on said support part that gives various types of ample multiple helping hands. By joining two support parts end to end with a coupler of the electrical connector type and by positioning at least one of the arms on each of said two support parts, the maximum opening is considerably extended.

Such connectors, when they are multiple, make possible a parallel coupling of the rods to build multi-contact vices or to perform multidirectional clamping [, possibly one after another,] by bending electrical connector bars (of which the coating is usually made out of a supple plastic material). [and securing them short to some of said support parts.]

Therefore a device according to the invention can be obtained by the global method comprising the following steps of:

[a)] providing a cylindrical support part, such as a rod or a tube, with a section circular or not,

providing two arms, each arm including a transverse hole and at least one of these arms carrying an elastic buffer secured thereto, said buffer having a contact face for contacting any object to be clamped and having under its contact face a thickness large enough so that said buffer acts as a compression spring when said buffer contacts said object, and being resilient enough such that said contact face can flex and pivot to substantially conform to the surface of said object, and

placing said arms on said support part such that said support part is disposed in said transverse holes of said two arms and at least one arm is movable along said support part, and said buffer is disposed at a distance from said support part with its contact face approximately at a right angle to said support part.

[b) placing on said support part two arms of which at least one is movable along said support part,

c) fitting one of said movable arms out at a distance from said support part with one substantially elastic buffer having under its contact face, which is approximately at a right

angle to said support part, a so large thickness that said buffer could act as a compression spring.]

The present invention can further be distinguished from the prior art evoked before when said substantially elastic buffers replacing the traditional cork pads are ring buffers elastic on all sides, but with a greater thickness under the contact face. There are numerous advantages of ring buffers over cork pads. First of all, there is no more need for a fastening system, such as a sticking, such as a pin and a hole, to secure the pad or buffer to the jaw. Additionally, the ring buffers can receive and support laterally other buffers fitting out others jaws, thereby enabling and facilitating all angular directions of clamping, whatever is the outline shape of the parts to be clamped. And of course, the ring buffers are easily interchangeable with differently contoured ring buffers, to seize for example pieces difficult of access. Thornton (US patent No. 4,834,352) thought for his handle-equipped clamping device of totally surrounding the jaw ends with safety pads having an uniform and slight (see Thornton p.4, lines 16-17) thickness. Clearly in view of their slight thickness, the purpose of these pads was to act as protecting wedges, but not as an essential means for exerting a pressure during clamping, let alone conforming to difficult shapes. The pressure means is materialized in Thornton by a big pin—shaped spring. In the present invention, the ring buffers are constituting the pressure means for the clamping and consistently they are thicker in the clamping direction which makes possible in addition of conforming to difficult shapes. That is in what the ring buffers are differing from the safety pads of Thornton. The difference is all the more marked since Thornton's device is clearly departing from the "hammer-press" concept. It is more like a clothes peg extrapolation towards a large opening with the traditional defects of the clothes peg:

jaws diverging from parallel during the clamping operation and force nearly impossible to be controlled because of the lever effect. The use of safety pads, which is otherwise classic (around pliers' noses or around fingers with gloves), is not liable to fundamentally alter the performances of the clothes peg. On the contrary, the use of ring buffers, as pads, for the "hammer-press", gives thereto new properties. For example, there is [, such as] the possibility in conjunction with another "hammer-press" according to the present invention, of clamping in all angular directions with an automatic control of the clamping force. That [, which] would be rather difficult if not impossible with Thornton's press.

So as [that] said at least two movable and removable arms [could] be easily slipped outwards of said support part and inwards again, the support part ends might be equipped with removable stops. Said removable stops might be of the type clips, riders, pins, keys, or sections of cylindrical supple sheath slipped on by a gentle forcing.

A device according to the present invention will be called an assembler for the rest of the description.

The clamping of an object with an assembler, comprising only two arms, consists [of] in positioning said object between said arms,

sliding said at least one movable arm along said support part so as to apply the contact face of said elastic buffer against a respective surface of said object,

manually exerting pressure upon the backs of said arms in direction of said object. The force exerted by fingers or hand palms on said backs is more or less transmitted by translation

against said object. This object reacts and opposes a resistance, which rises with the exerted pressure and

stopping the exertion of pressure when hands feel enough resistance. Said at least one movable arm is then repulsed by said object. As a result, it tilts with respect to said support part, such that a frictional force is created between said support part and an interior surface of the transverse hole of said arm, thereby locking said arm in place with respect to said support part. When said object is replaced by nothing between said arms, same maneuver also results into locking said at least one movable arm in place with respect to said support part by tilting. Each of said arms repulses the other one.

[pushing the last ones towards each other, the buffer of one of said arms having its contact face facing the contact face of the buffer of the other arm. The pushing force is translated more or less between the arms in front of the buffer(s). As soon as the resistance against the pushing is felt at the expected level, the pushing is stopped. Then the arms lock on by tipping against said support part as the suspended poles of the ski tow do against their cable, whether something would be held between the arms in front of the buffer(s) or not. The holding apart] Spreading between two surfaces is performed according to the same principle: the arms being reversed along the support part, pushing is made in the opposite direction.

The clamping operation is the same when the support part is split up into several cylindrical parallel components, distributed not along the arms unlike in Coffman, Ditto or Pappas, but at a right angle to said arms.

The clamping operation is somewhat different in the approach of the movable arms when the following conditions are met:

- (i) the [With an] assembler just [comprising] comprises four movable arms which can be turned in two directions V-diverging about said support part,
- (ii) said arms [being] are fitted out with elastic buffers,
- (iii) the buffers of the first two arms along said support part [having] have their contact faces facing towards a first direction and the contact faces of the buffers of the two following arms are facing towards a second direction opposite the first one [, the clamping operation is different in the approach of the movable arms, but the locking remains the same]. The two first arms are V-diverging around said support part and are [being] pushed towards the following ones, more or less positioned according to same V. Roughly the first arm buffer is facing towards the third arm buffer while the second arm buffer is facing towards the fourth arm one. But the locking principle remains the same. As soon as the buffer contact faces [are touching] come into contact with the surfaces of the [pieces] object to be clamped, the force exerted by fingers or hand palms on said first arms is more or less transmitted by translation against said object. This object reacts and opposes a resistance, which rises with the exerted pressure. Exerting of pressure can be stopped when hands feel enough [and as a sufficient] resistance. Said movable arms are then repulsed by said object. As a result, they tilt with respect to said support part, such that a frictional force is created between said support part and the interior surface of the transverse hole of said arms, thereby locking them in place with respect to said support part. [is felt, pushing is stopped.] Such a clamping operation has been called

“overlapping” and such an assembly of four movable arms on a cylindrical support part has been called “overlapper” or “super-assembler”.

The overlapping can be used as well for [holding apart] spreading. The operation is the same except those [that] arms are reversed along the support part. A configuration halfway between a single assembler and an overlapper or super-assembler according to the present invention can be obtained by using two movable arms V-diverging facing a single third one for the clamping. Depending on the relief of the surfaces to be held, such a configuration might be sufficient.

With the overlapping which offers four contact faces, one can notice a spectacularly more vigorous [vigourous] and stable clamping than with an assembler comprising only two movable arms, even upon tortured patterns. When an overlapper is clamping a small wood plaque upon a table edge with about 60° as an angle for the V formed either by the first arms or by the following ones, it is extremely difficult to detach said wood plaque from the table. And however [, whereas] each movable arm only underwent the thrust of one finger extremity during the clamping operation. To perform such a detaching, one hand [grabing] grasping the small wood plaque with all fingers and drawn itself by a human arm of medium strength is insufficient. On the other hand, it appears that it is quite possible to carry out a stable and efficient clamping even if the four buffers are pressing by their contact face at different levels upon a tortured relief. Such a possibility is of course extremely practical for the restoration of gilded artifacts such as frames and cartouches. With the sub-variant of the overlapper comprising only three arms, two first ones forming a V and a third one pressing more or less in front of the middle of the V, one can avoid obstacles which prevent from clamping oppositely.

Thus [for clamping a foot against the clock pedestal, this foot being opposite a column which stands above the pedestal,] when the buffers of said movable parts forming the V [are taking hold] press the pedestal of a clock on both sides of [said] a column, [while] the buffer of the opposite movable arm [is pressing] can press against the pedestal [upon said] a foot opposite the column.

If a third pair of movable arms fitted out with such buffers is added onto a bare portion of the support part of an overlapper, one gets a helping-hand. When the overlapper grasps [grasping] the lateral edge of an horizontal bench or table, [and if] said third pair [is holding] can hold some objects to be painted or to be worked [on] with free hands [, one gets a helping hand]. This helping hand is called a [third] three-element vertical helping-hand. If to this third pair of movable arms, called a holder, is added a fourth, a fifth, etc.[..] pair of movable arms, still placed on a bare portion of the support part, one gets successively one [fourth] four-element, one [fifth] five-element, etc. vertical helping hand. When each of the added pairs of movable parts, also called holders, can be turned in several directions around said support part, these auxiliary hands are even more practical.

One can get another configuration of auxiliary hands by placing along said support part, one behind the other, three pairs of movable arms fitted out with substantially elastic buffers, said buffers facing each other by their respective contact face for each pair. At one end of the support part, the two first pairs of movable arms are separately locked by clamping with each buffer having its contact face against the contact face of the other buffer at an angle not equal to zero but possibly markedly upper or lower than 90°. Along the remaining portion of the support part, the third pair of movable arms also constitutes a holder to hold objects to be

painted or to be worked on with free hands. The so-built helping-hand is called for the remainder of the present specification a [third] three-element horizontal helping-hand. It can be installed anywhere on a more or less horizontal surface because it rests on three feet: the sets of the buffers of the first two pairs of movable arms locked at one end of the support part and the other end of the last one. If to this third pair is added a fourth, a fifth, etc.[.] pair of movable arms, still placed on the remaining portion of the support part, one gets successively one [fourth] four-element, one [fifth] five-element, etc. horizontal helping-hand.

Nota bene: So that one of the above-mentioned helping hands could keep objects in position firmer, one overlapper can replace one holder.

The interest of the just above described helping hands as compared with the traditional helping-hands lies in different aspects:

- Firstly, the holders that are equipping the helping hands according to the invention cannot with their elastic buffers scratch held pieces as the crocodile clips of the traditional helping hands can do with their teeth.*
- Secondly, unlike crocodile clips these holders are provided with jaw members which can open very widely while remaining parallel to each other.*
- Lastly, the helping hands according to the invention are distinctly lighter than the traditional helping hands since they do not require a heavy pedestal to keep standing, even when the holders are loaded. Four of the movable arms [which] that are placed along the support part are sufficient to steady the basis of such kinds of helping-hands (see above). That just shows the generic power of the combination: cylindrical support part, movable arms and substantially elastic buffers.*

Of course, configurations as the overlapper and the vertical and horizontal helping hands can only be built because of the possibility for the movable arms to be turned in more than one direction around the support part.

The modularity of the assemblers, which derives from the movability of the arms along the cylindrical support part, is creating a faculty not available up to now with the clamping tools: increasing at will the maximum opening. Said arms can be slipped outwards of their support part (the possible stops at ends thereof are removable) and slipped onto another support part of same section. Cylindrical support parts can be fixed end to end by couplers such as electrical connecting devices, muffs for mechanical pipes or cable links. It matters little that the couplers are barriers against the mobility of the arms between the different support parts. Placing one movable part on each of the two most extreme portions of said support parts is sufficient and the maximum opening between the two so used movable arms is inevitably larger than it would be if these two arms would be placed on only one of these support parts. In this manner the maximum opening according to the invention easily becomes extensible, which contrasts sharply with the traditional clamps where the extension [binding of one of the jaws to one of the end] of the support part [makes inconceivable the extension thereof] is not permitted. Naturally, if not one but several movable parts are placed on each of the two most extreme portions of the support parts so connected end to end, it is possible to give a considerable maximum opening to all above disclosed original variants of the invention, as the overlapper and the new kinds of helping hands, etc.[.]. On the other hand, it can be also contemplated extending a support part with support parts having a different section by couplers the inlets of which being fit for

different diameters. In this way [(this is the case of connecting devices for big section electrical wires) so that] movable arms having different dimensions could be faced to each other. Depending upon the shape of the objects to be clamped, such an arrangement dimensions could [can] be very helpful. Connecting devices for big section electrical wires can provide couplers with inlets fit for different diameters.

According to a somewhat similar arrangement, denominated "radial clamping", on the support part of an assembler including a minimum of two movable arms is secured a coupler. This coupler is fit to seize, in at least one direction distinct from said support part direction another support part which can carry a minimum of one movable arm provided with an elastic buffer. Such a coupler is possibly made of a crosspiece like those which are used in electricity as a shunt contact or those which are used in the Navy or in "Mecano" building set to secure the crossing of two cables or halyards. It might also consist of a little bar of electrical connecting devices which is kept bent for example by the way it is secured to the first of said support parts. If this support part and another of said ones are at an angle of about 90°, it is possible to clamp things by three sides (T clamping) or by four sides (cross clamping). And when the coupler can hold several support parts in directions all distinct from the direction of the support part upon which the coupler is secured, it is possible to clamp things by numerous sides between the movable arms which are carried by said support parts. Such a way of clamping is then called a radial clamping. Of course said ways of clamping [clampings], the T one, the cross one and the radial one, can be operated with movable parts combined in overlappers. With the radial clamping, it is possible of pulling towards each other the corner sides of a frame and of gripping round objects markedly more firmly.

Another faculty brought by the invention also results from the movability of the arms along the cylindrical support part. Spreading with an assembleur of two reversed movable parts, each provided with an elastic buffer, between a surface and an auxiliary bar kept parallel to said surface makes possible to press at any place of this surface along this bar. [One of the movable arms of a holder apart according to the invention, i.e. an assembleur of which the movable parts have been reversed along its support part, said assembler comprising just two movable arms, each of them being fitted out with an elastic buffer, can be slipped at one of the furthest ends of the support part (the possible stops are removable). If an] An auxiliary bar, such as a ruler or a tool handle, [is] can be kept [fastened] parallel to a [large] surface [(for example,) by the holders of two [third] three-element vertical helping-hands [according to the invention,] of which the [overlapper of one of said two vertical helping hands gripping an edge] overlappers grip two opposite edges of said [large] surface, [which is opposite the edge of same surface gripped by the overlapper of the other vertical helping hand), it is possible with the buffer of this movable arm to press at any place of this surface along this bar.] There is no risk for the support part of damaging said surface if the movable part having its elastic buffer pressing the surface is slipped at one of the furthest ends of the support part since [it] the last one does not go beyond said buffer. [movable arm. The assembler working as an holder apart, it is sufficient that its other movable arm buffer takes support against the auxiliary bar. By reason of this] This kind of clamping [which] has been called "covering clamping". Thus it is possible to press against a surface very far from its edges, provided the auxiliary bar would be large enough. In this way, the jaw depth [or projection] of the movable parts is made potentially unlimited. And

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whatever the shape of the [The assembler can exert a pressure whatever is the distance from the edge of a large] surface [, possibly] is plane, convex, concave or tortured, that is true. It is sufficient that the auxiliary bar more or less follows the outlines of the surface [be long enough and positioned in the good direction]. For a stronger pressure, an overlapper might replace the assembler that [which] has to be turned into a spreader [holder apart might be replaced by an overlapper]. Until now this type of clamping by covering was not much familiar to persons having ordinary skill in the art, because traditional clamps could not generally be turned into [holders apart] spreaders and a [holder apart] spreader was a special tool rarely available in the workshops. In addition wedges are rather difficult to be used with a traditional [holder apart] spreader. According to the present invention, the covering clamping can be easily and directly executed with the very same assemblers as the ones which permit of making all the other above disclosed original arrangements, provided if needed with additional movable arms. It is the multipurpose characteristic of the new assembler.

Another worthwhile feature of the invention [, when every movable arm is fitted out with a ring buffer,] is that a ring buffer belonging to a clamping or spreading [holding apart] assembler can support against its side, under various angles, the pressure of a buffer belonging to a second assembler in clamping or spreading [holding apart] position. This feature results from that every elastic substance, which can go into such a buffer, is malleable and generally not slippery. Therefore the buffer of another movable arm of said second assembler can force against the side of an object even this last one has [not another] no other side parallel to said first side or against a buffer belonging to a third assembler, also in clamping or spreading [holding apart] position. Such a positioning permits [of clamping] to clamp even there is no outline easy to be seized, which is often the case of objets d'art to be restored. This positioning was so far very difficult to be achieved with traditional clamps because sizeable and crooked wedges had to be jammed under the jaws, said wedges being always uneasy to be put in and sometimes hard to be found out. Generally such a positioning was requiring more than two hands and was brutishly forcing whatever was the solidity of the objects to be clamped. This positioning turns to be elementary, even under a weak clamping force, with the new assembler, owing to the use of elastic ring buffers. It has been called angle clamping, staple clamping or bridge clamping, according to the number of assemblers, which are involved. For a firmer anchorage, [the supporting assembler possibly can be replaced by] an overlapper might replace the supporting assembler.

The result of all the foregoing is that the assembler according to the invention is multipurpose and that its general process of use, which permits of holding a set of objects by clamping without damaging them, comprises the following steps:

positioning said set of objects between said arms,
sliding said at least one movable arm along said support part so as to apply the contact face of said elastic buffer against a respective surface of said set,
manually exerting pressure upon the backs of said arms in direction of said set. The force exerted by fingers or hand palms on said backs is more or less transmitted by translation against said set. This set of objects reacts and opposes a resistance, which rises with the exerted pressure and

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stopping the exertion of pressure when hands feel enough resistance. Said at least one movable arm is then repulsed by said set. As a result, it tilts with respect to said support part, such that a frictional force is created between said support part and an interior surface of the transverse hole of said arm, thereby locking said arm in place with respect to said support part.

[a) applying the buffer secured to each of said arms against one of said objects or against one of the sides of a buffer secured to another arm or against some auxiliary rigid element,
b) exerting on the back of each of said arms along the support part which carries said arm, a manual thrust,

c) stopping this thrust, so as to lock each of said arms by tilting against the support part which carries said arm.]

Other characteristics and advantages of the invention will be more apparent from the following detailed description in view of the attached drawings, upon which:

6. **BRIEF DESCRIPTION OF THE DRAWINGS**

- FIG. 1 is a sectional elevation of an assembler according to the invention comprising two movable arms wherein only one arm is provided with a substantially elastic slice-shaped buffer.

- FIG. 2 is a sectional elevation of an assembler according to the invention comprising two arms, wherein each of said arms is provided with a substantially elastic slice-shaped buffer.

- FIG. 3 is a sectional elevation of an assembler according to the invention comprising two arms, wherein each of said arms is provided with a substantially elastic ring buffer.

- FIG. 4 is a sectional elevation showing how the assembler of FIG. 2 can be used for pressing an assembly of two objects.

- FIG. 5 is a perspective of an assembler according to the invention comprising four movable arms arranged as an overlapper wherein each one of said arms is provided with a substantially elastic ring buffer.

- FIG. 6 is a perspective of an assembler according to the invention comprising six movable arms arranged as a vertical [third] three-element helping hand, each arm being provided with a substantially elastic ring buffer.

- FIG. 7 is a perspective of an assembler according to the invention comprising eight movable arms arranged as a horizontal [fourth] fourth-element helping hand, each arm being provided with a substantially elastic ring buffer.

- FIG. 8 is a perspective of an assembler according to the invention wherein the support part has secured thereto a coupler which supports another support part in a direction perpendicular to that of the first said support part [,.]. And said another support part is carrying two other movable arms each provided with a substantially elastic ring buffer.

- FIG. 9 is a side view of an assembler according to the invention wherein the support part is made of two distinct cylindrical portions connected end to end in a row by a coupler, each of said portions carrying one arm provided with a substantially elastic ring buffer.

- FIG. 10 shows a sectional elevation of a ring buffer according to the invention.

- FIG. 11 shows a sectional elevation of a ring buffer according to the invention.

- FIG. 12 shows a perspective of an assembler according to the invention wherein the support part has been split up into three parallel beams. These beams are linked to each other at

each of their ends by a coupling device. The elastic buffer that carry each movable part is split up into three buffers which are coupled by the movable part itself.

- FIG. 13 shows a perspective of the assembler of FIG. 12 wherein each movable part is itself split up into three equivalent subparts.

- FIG. 14 shows a perspective of the assembler according to the invention wherein each movable part comprises two portions firmly secured to each other, a shackle including a transverse hole in which said support part is disposed and another portion carrying said elastic buffer.

6. BEST MODE FOR CARRYING OUT THE INVENTION

Referring now to Fig. 1 to [8] 14, a multipurpose clamp according to the present invention hence comprises in combination:

- a cylindrical support part 1, such as a rod or a tube, with a section circular or not,
- two arms 2, each arm including a transverse hole. Said support part 1 is disposed in said transverse holes of said arms such that [of which] at least one of said arms is movable along said support part 1,
- one substantially elastic buffer 3 secured to one of said arms 2. Said buffer has a contact face for contacting any object to be clamped and has under its contact face a thickness large enough so that said buffer acts as a compression spring when said buffer contacts said object. Moreover said buffer is resilient enough such that said contact face can flex and pivot to substantially conform to the surface of said object. And said buffer is disposed at a distance from said support part 1 [and having under] with its contact face [, which is] approximately at a right angle to said support part 1 [, a so large thickness that said buffer could act as a compression spring].

It may be added a stop 4 at least to one end of said support part [a stop 4]. Said stop can [to] prevent said of arms 2 which are movable from slipping away out of said support part 1 when they are not held back on said part by some clamping action and said support is kept more or less upright.

As it has been said before, a device according to the invention has been called an "assembler". To be substantially elastic and thick enough to act as a compression spring said buffer 3 must be made of an elastic substance, supple like natural or synthetic rubber, foam plastic or even cotton, and that its thickness under the contact face must be larger than one millimeter. It can be full or spongy structured. It can also be made of a hollow flat box with thin wood, hard plastic or metal walls, which have the property of straightening up them [themselves] when the pressure exerted upon them is reduced. Said contact face is more or less flat or slightly bowl-shaped and its seat is mainly at a right angle to said support part. For some applications however, said contact face can be convex. Said buffer can have also the shape of a slice [sticked] bonded on said movable arm or the shape of an obturator, which has a protuberance that is thrust into a hole made in [fixed by a spike on] said movable arm. It may have as well the shape [or the form] of a ring slipped onto same arm at a distance from said support part. The advantage of a ring as a buffer as compared to a slice or an obturator is its capacity to be fixed on said arm without needing to bond or to perforate [sticking on or boring an opening through] said arm. Its internal dimensions must only be smaller than or at the most equal to

said arm external dimensions at the place where it has to be secured, so that it can be forcibly slipped on the arm to said place and stay locked thereon.

According to another arrangement, the buffer is made up of a pile of substantially elastic slices in the way of a Belleville washer spring. In [;in*] a first sub-arrangement, slices are bonded [*sticked*] one on top of the other. In [*;in*] a second sub-arrangement, slices are pierced and slipped on top of the other too by a gentle forcing onto a second cylindrical part which is parallel to said support part. Said second cylindrical part is [*slidingly*] slid and positioned behind said buffer contact face through the arm which carries said buffer and is held back by a stop similar to the ones which might end said support part.*

*One of said means to permit one of said movable arms 2 of sliding along said support part 1 is [*constituted by*] made of a passage hole, of which the inner shape surrounds very closely the outline of said support part 1. But such a means may also consist of a [*cradle-stirrup*] shackle secured to said arm 2 side, said [*cradle-stirrup*] shackle forming a loop. Another [*;another*] possibility is to shape said passage hole by building each of said arms 2 with two half-arms each provided within its thickness with a cylindrical semicircular groove, the groove hollow of each half-arm facing the groove hollow of the other half-arm. [*; a*] similar possibility is to put in one side of a whole arm, within its thickness, a cylindrical groove and to close this one longitudinally by a plate; it can also be considered of wrapping a tenon piece of said arms by a hollow rail constituting said support part.*

Referring to FIG. 1 to [8] 9 and 14, each stop 4 is composed by a section of cylindrical supple tubular sheath the diameter of which being slightly smaller than the average diameter of said support part. Said section is slipped on at end of said part by a gentle forcing. Such stops can also consist of clips, riders, pins or keys. But as compared with these last means, using some supple sheath to slip by force on said support part is an especially economical means. No [, since no*] machining of said cylindrical support part and no special tools for manufacturing said stops are indeed required even if said support part section is out of standards. Such a sheath can be found easily, because there is generally no special requirement, such as resistance to temperature rise or to hostile environment. Only said sheath section must be a little smaller than said support part average diameter and said supple sheath must keep its elasticity in the course of time with normal environmental conditions. Can be suitable for said sheath: supple tubes of PVC, medium or low-density polyethylene, silicone, natural or synthetic rubber.*

*FIG. 1 shows an assembler according to the invention including only two movable arms 2. A single substantially elastic buffer 3 is involved. It consists of a slice adhering to its carrying movable arm 2 by [*sticking*] bonding thereon or of an obturator, which has a protuberance that is thrust into a hole made [*by a spike which has been made penetrated by force into a hole bored*] in said arm 2.*

*As for FIG. 2, it shows an assembler according to the invention including only two substantially movable arms 2 where two elastic buffers 3 are employed, one per arm. Each of these buffers consists of a slice adhering to its carrying arm 2 by [*sticking*] bonding thereon or of an obturator, which has a protuberance that is thrust into a hole made [*by a spike which has been made penetrated by force into a hole bored*] in said arm 2.*

As for FIG. 3, it also shows an assembler according to the invention including only two substantially movable arms 2 where two elastic buffers [3] are employed, one per arm. But each

of these buffers consists of a ring 3r of rubber or other material or an equivalent plastic alveolar [alveolate] structure slipped by forcing onto its carrying arm 2. Both FIG. 10 and FIG. 11 show a ring buffer in sectional elevation.

In view of FIG. 4, to [operate a] perform clamping with an assembler according to the invention and including only two movable arms 2 provided with substantially elastic buffers 3, it is enough of:

- positioning [bringing] the set of [the] objects 8-9 to be clamped between [the] arms 2,
- sliding arms 2 along support part 1 so as to apply [opposite] the contact faces of [the substantially] elastic buffers 3[;] against the outer surface of said set of objects,
- manually exerting pressure [pushing with fingers or the hand palm] upon the backs of [the] arms 2, [on the reverse side of said contact faces,] in direction of [said] objects 8-9. [; arms 2 then slide along said support part; as soon as said contact faces are touching said objects 8-9 by the surfaces to be held, the fingers are feeling a resistance as if they were directly pushing on said objects: it is] The force exerted by fingers or hand palms on said backs is more or less transmitted by translation [more or less the resistance exerted by the] against objects 8-9. These objects react and oppose a resistance, which rises with the exerted pressure.

- stopping the exertion of pressure when hands feel enough resistance; arms 2 are then repulsed by objects 8-9 and tilt with respect to said support part, such that a frictional force is created between said support part and an interior surface of the transverse hole of each arm 2, thereby locking said arms in place with respect to said support part.

[- going on to push upon backs of arms 2 while increasing pressure so as to compress the buffers;

- As soon as the hand is feeling that has been reached the force sufficient to suitably clamp said objects against each other, stopping to push; movable arms 2 are locking on then automatically and instantly by tipping against said support part as the suspended poles of the ski tow do against their cable.]

It is worth noting that an assembler according to the invention performs as a relay of the human fingers or hands (in the sense of replacing) for the accomplishment of a task like clamping. It can actually keep a clamping position as long as it is needed under the same effort the hand(s) can temporarily hold.

[A single pushing upon the reverse] Pulling the tail of said arms 2 opposite the clamping area and close to [with respect to said objects 8-9 at a distance beyond] said support part 1 [from said buffers] is enough to unlock said arms 2 and to release from clamping the set of objects 8-9.

[The holding apart operation with] Spreading an assembler according to the invention including only two movable arms is performed in a similar way. However, the arms must be first reversed along said support part so as to turn the contact faces of said buffers towards the outside. These contact faces are brought into contact of the objects to be held apart. The operation is then carried out further on in a way similar to the clamping operation [as soon as the [fingers or the hand palm] hands begin to push upon the back of said arms,] except that the [force] resistance to be manually felt must equal the force [is the one with which] that it is wanted [to hold apart] for spreading.

FIG. 5 shows a variant of the assembler including [only] four movable arms, each of [said arms] them having a substantially elastic ring buffer [3] 3r secured thereto at a distance from

said support part 1. Buffer 3r of arm 2a has its contact face facing towards the contact face of buffer 3r of arm 2d, while buffer 3r of arm 2b has its contact face facing towards the contact face of buffer 3r of arm 2c. [, the buffers of the first two arms 2a and 2b along said support part 1 having their contact faces facing the contact faces of the buffers of the two following arms 2c and 2d. The first two arms] Arms 2a and 2b are [pointing in two directions] V-diverging about said support part and consequently [are facing the two following] arms 2c and 2d [,] are more or less arranged according to same V. [Roughly the buffer 3 of first arm 2a is facing the buffer of third arm 2d while the buffer of second arm 2b is facing the buffer of the fourth arm 2c.] As it has been told above, such a configuration has been given the name of "overlapper" or "super-assembler". And [and] the clamping operation, which consists in moving closer the two pairs of movable arms V-diverging towards [V from] each other, the name of overlapping.

[It is enough to manually push upon the backs of the movable arms along said support part 1 towards the objects to be clamped. As soon as the buffer contact faces are touching the surfaces of said objects and as a sufficient resistance is manually felt, it is enough to stop pushing. The movable arms 2 are then locking clamped onto said objects still by tipping against said support part.] The overlapping can be used as well for [holding apart] spreading. The operation is the same except those [that] arms are reversed along the support part. A configuration halfway between a single assembler and an overlapper or super-assembler according to the present invention consists in using two movable arms V-diverging in front of a single third one for the clamping. Depending on the relief of the surfaces to be held, such a configuration might be sufficient.

As for FIG. 6, a third pair of movable arms 2e-2f, called a "holder" is [slipped] placed by slipping on the bare portion of the support part 1 of an overlapper comprising two pairs of movable arms 2a-2b and 2c-2d grasping the edge of an horizontal bench or equivalent. Each arm of said third pair [arms] has also secured thereto a substantially elastic ring buffer 3r. Such a [an] holder in clamping or spreading [holding apart] position can keep in position some objects to be painted or to be worked on with free hands. Such a configuration has already been given the name of [third] three-element vertical helping-hand.

FIG. 7 shows another configuration of helping-hand: a [fourth] four-element horizontal helping-hand. It includes four pairs of movable arms 2a-2b, 2c-2d, 2e-2f, 2g-2h, placed one behind the other along said support part. Each of said arms has secured thereto one substantially elastic ring buffer 3r. [3, said buffers] For each pair of arms, either buffer has its contact face facing towards the contact face of the other buffer. [each other by their contact face for each pair.]

At one end of the support part, the two first pairs of movable arms 2a-2b and 2c-2d are separately locked by clamping with each buffer having its contact face against the contact face of the other buffer. The two pairs are positioned at an angle close to 70°. Along the remaining portion of the support part, the third pair of movable arms 2e-2f and the fourth pair [couple] of movable arms 2g-2h are constituting "holders" for keeping objects in position to be painted or to be worked on with free hands. Of course the buffers of the two first pairs of movable arms 2a-2b and 2c-2d locked at one end of the support part are making up with the other end of said support part a tripod. Each holder can be used as an assembler comprising two movable arms for clamping or [holding apart] spreading operations.

Nota bene: So that one of the above-mentioned helping-hands could keep objects in position firmer, one overlapper can replace one holder [holder can be replaced by one overlapper].

FIG. 8 is showing a "radial clamping". On the support part 1 of an assembler according to the invention is secured as a coupler a pliable little bar 5 of electrical connecting devices, which has been bent. Said support part 1 is carrying two movable arms 2a-2b, each of them having secured thereto one [substantially] elastic ring buffer [3] 3r. Said bar 5 is bent because it is secured on said support part 1 by two contacts 6 and 6a which are normally far from each other and which have been brought closer by torsion of the little bar within its medium plane. The screws of said contact screws are turned tight against support part 1, i.e. they are jammed against it. The middle contact 7 of the little bar is used to secure, still by screwing thereagainst, another cylindrical support part 1a which carries two other movable arms 2c-2d, each of them having secured thereto one [substantially] elastic ring buffer [3] 3r. The first support part 1 is more or less at a right angle to the other support part 1a. The clamping operation for each pair of movable arms 2a-2b and 2c-2d is identical to the operation for an assembler according to the invention comprising two movable arms. In this way, as illustrated in FIG. 8, it is possible to clamp things by four sides between the movable arms that [which] are carried by these two support parts. Such a clamping has been given the name of cross clamping. It would be also possible with some additional cylindrical support parts, each of them held by other contacts of the little bar and carrying [each] at least one movable arm, to clamp [of clamping] things by a vast number of sides. Such a clamping has received the name of [, which is a] radial clamping. In the same way, to said second support part 1a can be secured another coupler holding a third support part 1b in a direction distinct from the directions of the first two support parts. Possibly [, and possibly] one more coupler can be secured on this third support part, and so forth to build a chained radial mounting. Such a chain configuration might be helpful to clamp the objects with complicated outlines. Another model of coupler can consist [in] of a crosspiece including two or more pipes which are diverging and which can keep [captive] secured by a screw system or the like a support part like a rod or a tube. This kind of crosspiece is used for instance in electricity as a shunt contact. Crosspieces are also employed in the Navy or in "Mecano" building set to secure the crossing of two cables or halyards.

FIG. 9 gives an example of length extension for the support part of an assembler by connecting end to end in a row two support parts 1a and 1b with the help of a coupler 8.[.] Support part 1a is carrying movable arm 2a while support part 1b is carrying movable arm 2b. Both arms are provided with a substantially elastic ring buffer [3] 3r. Of course, between [betwween] said support parts 1a and 1b might be inserted the result of connecting end to end by other couplers 8 in a row several other support parts. These couplers might be as well electrical connecting devices as muffs for mechanical pipes or as cable links with locking devices such as screws or nuts. In this way, the maximum opening capacity of any assembler can be increased as much as it is liked since this capacity is all the larger that the support part length is larger. It matters little that said couplers are barriers against the mobility of said arms between the different support parts. Just placing one movable part on each of the two most extreme portions of so-extended support part is sufficient when a clamp with the maximum opening capacity is wanted.

In another arrangement of the assembler according to the invention including only two movable arms 2, the support part 1 is split up into several cylindrical parallel components, which constitute [are constituting] in fact so many parallel and homogeneous support parts. Said components are made interdependent at each of their ends by couplers which might look like little bars of electrical connecting devices when said components have almost the same diameter. Each of said arms might be running along all these components. Each arm has a wide pressing face. In a first kind of such an arrangement [subarrangement], the elastic buffer 3 secured to one or each of both arms is formed of one piece. [In] FIG. 12 shows a second kind of such an arrangement, wherein [subarrangement, the substantially elastic buffer 3 carried by one or] each of both movable arms has secured to a substantially elastic buffer which is split up into several pieces, here three ring buffers 3ra, 3rb and 3rc. Said [; in this case, said pieces] ring buffers 3ra, 3rb and 3rc are located at a single distance from the [median] medium plane, which contains the different, here three, cylindrical components 1a, 1b and 1c of said support part. Said [; said pieces might be] ring buffers 3ra, 3rb and 3rc are left working independently from each other. But in a third kind of arrangement, these pieces are [or] sandwiched between the arm which is carrying them and a rigid linking plate meant for acting as a jaw towards objects to be clamped. The sandwich configuration with several substantially elastic buffer pieces [put] sandwiched between the arm which is carrying them and a rigid plate turns out to provide a firmer [clamping] grip than the single buffer configuration for the same [compression] clamping force. Of course, this implies a synergetic effect. [In the second kind] FIG. 13 shows a variant of the arrangement of FIG. 12, wherein each of movable parts is [subarrangement, when the buffer is split up into several pieces, the arm might be] itself split up into several blocks, here three blocks 2a, 2b and 2c. [each] Each of these blocks is carried by one or several, here one, of the components of the support part. As said components constitute [are constituting] so many parallel support parts, it is as if several assemblers according to the invention were coupled together in parallel to make up a multipoint vice. In FIG. 12 and FIG. 13, each of the stops, which are fitted onto at the ends of the support part, is split into three pieces, 4a, 4b and 4c, as many as there are components for the support part. And the components of the support are made interdependent at each of their ends by couplers 11, which encircle them separately.

FIG. 14 shows an assembler having two movable parts, each of them comprising two portions: one shackle 21 including the transverse hole in which the support part 1 is disposed and another portion 22 carrying a substantially elastic buffer 3r.

It is worth noting moreover that the device according to the invention might find many applications such as securing an apparatus to a support when said apparatus is made interdependent of or is constituting one of said arms.

It stands to reason that this invention was only described and illustrated on a purely explanatory and not in the least restrictive basis and that it will possible to make any variant of it without getting off its scope.

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